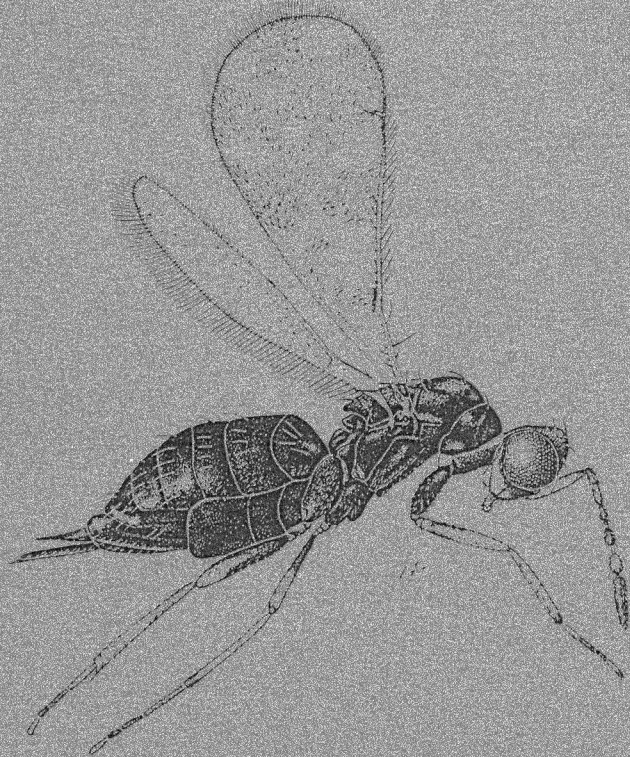


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## THE AUSTRALIAN ENTOMOLOGIST

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**Cover:** Minute wasps of the eulophid genus *Astichus* are mostly parasites of the larvae of ciid beetles living within the fruiting bodies of bracket fungi. This undescribed species is about 2mm in length and occurs in the rainforests of eastern Australia from southern New South Wales north to the Wet Tropics of Queensland. Illustration by Geoff Thompson.

**THE PREVIOUSLY UNDESCRIBED FEMALE OF *DELIAS SHUNICHII* MORITA (LEPIDOPTERA: PIERIDAE) FROM NEW BRITAIN, PAPUA NEW GUINEA**

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**Abstract**

The female of *Delias shunichii* Morita is described and figured for the first time. The current placement of *D. shunichii* in the *nigrina* species group is discussed and observations are made on its morphology.

**Introduction**

The genus *Delias* Hübner is represented in New Britain by seven known species (D'Abrera 1990, Morita 1996). *Delias shunichii* Morita is the most recently described species.

Unlike mainland Papua New Guinea, the highlands of the Bismarck Archipelago are largely uninhabited and difficult to access. Therefore, butterfly taxa from this area, including the distinctive *D. shunichii*, are scarce in collections.

Between 1952, when Brandt collected in Rabaul and Keravat (Parsons 1998) and the 1960s-70s, when several expatriate Australian collectors (including H. Borch and R. Carver) were active in the area, very few *Delias* were caught in New Britain. One of us (RG) was resident in Rabaul from 1968 to 1972 but no reliable *Delias* collecting site was found until late in 1972. However, in mid-1972, a single specimen of an unusual *Delias* species (now recognised to have been *D. shunichii*) was observed but not captured at Raburua (50 m above sea level), near Rabaul. The species remained a mystery until Morita's (1996) publication. This prompted a search (conducted by correspondence and spread over a wide area), which has lasted for several years, culminating in the capture of a single female in late 2001.

*Delias shunichii* was described from a single male (Morita 1996). At that time the female was unknown. For purposes of comparison the male is redescribed here in greater detail, based on Morita's (1996) brief description and figures and additional, recently collected specimens. A detailed description of the single known female is provided below.

***Delias shunichii* Morita**

(Figs 1-4)

*Material examined.* PAPUA NEW GUINEA (NEW BRITAIN): 2 ♂♂, 1 ♀, East New Britain Province, ~ 900 m, 21.xii.2001 (♀) & 2.xi.2002 (♂♂) (in R. Gotts collection).

*Description.* Male (Figs 1-2). Forewing length 32.5 mm. Head and thorax dorsally black; abdomen dorsally grey. Head, thorax and anterior portion of



abdomen ventrally orange-yellow; posterior of abdomen white. Forewing upperside white tinged with grey distally; apex and costa black; outer margin to tornus broadly black but not entering discal cell. Forewing underside ground colour black, covering all but a narrow white strip along the inner margin (below vein 1A+2A); basal anterior lobe of costa edged with yellow; subapical band of 5 white spots. Hindwing upperside white with broad black margin extending into subterminal area. Hindwing underside black with large red sub-basal spot occupying most of cell Sc+R<sub>1</sub>, yellow scaling present basally; broad red median band entering outer third of cell and extending slightly beyond, not reaching costa or inner margin.

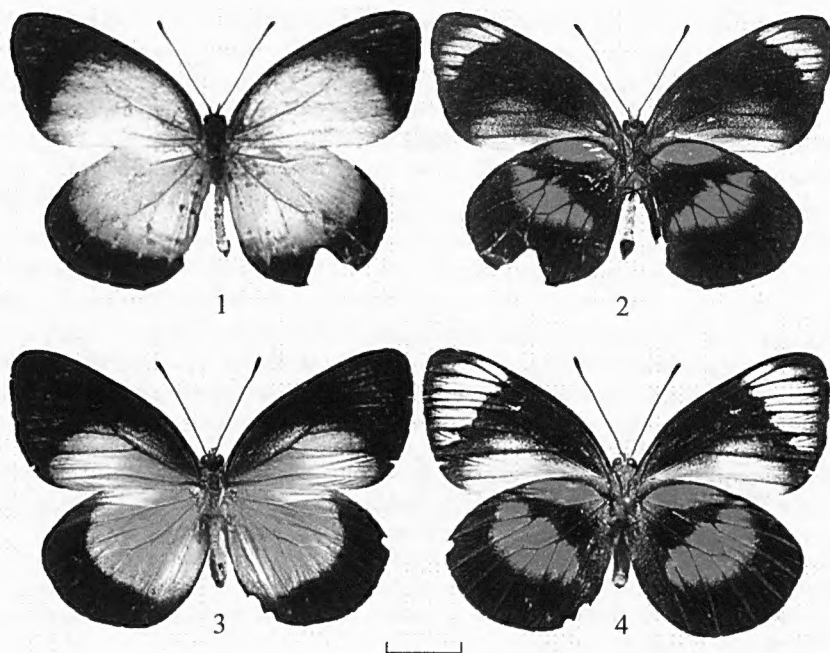
Female (Figs 3-4). Forewing length 33 mm, antenna 15 mm. Head dorsally black, ventrally pale yellow; antenna black; labial palpus pale yellow; thorax clothed with pale yellow hairs; legs black, femora with yellow hairs; abdomen pale yellow. Forewing upperside ground colour white; basal one-third of white areas suffused with clear pale yellow; black margins broader than in male; black area very broad along costa almost completely filling discal cell, leaving just a narrow band of yellow with black dusting above cubitus; black margins on both wings grade to grey along inner edges; veins black; submedian area yellow, extending to origin of vein CuA<sub>2</sub>; distad of CuA<sub>2</sub> white. Forewing underside ground colour black; broad submarginal band of six white spots extending from costa to vein CuA<sub>2</sub>, much broader than in male and separated by black veins; small white disco-cellular spot present; posterior half of wing white extending from inner margin to cubitus, filling proximal third of cell CuA<sub>1</sub> and most of cells CuA<sub>2</sub> and 1A+2A; basal third of white area suffused with pale yellow scales; black border of outer margin ends at tornus and extends along veins. Hindwing with termen more convex than in male; upperside ground colour white; black margins broader than in male; white area suffused with yellow in basal half of cell Sc+R<sub>1</sub>, and extending from vein Rs to 1A+2A, remaining white distally. Hindwing underside ground colour black; red sub-basal spot almost entirely occupies cell Sc+R<sub>1</sub>; yellow scaling prominent in basal area, diffusing with black ground colour, and extending to proximal region of costa, sub-basal red spot and discal cell; red median band much broader than in male, with red areas more extensive distally; red median band commencing with vestigial spot in distal portion of cell Sc+R<sub>1</sub>, then continuous from vein Rs to 3A and including distal third of discal cell; median band distally convex.

*Early Stages.* Unknown.

## Discussion

The Bismarck Archipelago contains a significant number of endemic butterfly species. All Bismarck *Delias* species are endemic except *D. messalina* Arora and possibly *D. lytaea* Godman & Salvin (Parsons 1998), which are also known from the Solomon Islands. *D. shunichii* appears to be one of the endemic Bismarck species.





Figs 1-4. *Delias shunichii* from New Britain. (1) male upperside; (2) male underside; (3) female upperside; (4) female underside. Scale bar = 10 mm.

Talbot (1928-1937) divided *Delias* into 22 groups according to their genitalic and androconial form (Müller 2001). A further monotypic species group was proposed by Müller (2001) for the placement of *D. brandti* Müller from New Ireland. Morita (1996) suggested that *D. shunichii* should be assigned to the *nigrina* species group, based on morphological features (i.e. forewing upperside white with black margin, forewing underside black with white subapical band, hindwing underside with red sub-basal spot and red discal markings).

Superficially, *D. shunichii* does share some characteristics with members of the *nigrina* species group, particularly with *D. messalina*. The yellow colour of the female *D. shunichii* body and upperside wing surface is a close match with the colour of the abdomen and of the smaller yellow area on the upperside of the female of *D. messalina*, at least in the subspecies *D. m. lizae* Müller. *Delias shunichii* also displays features observed in members of the *belisama* group, such as the presence of a small white discocellular spot on the forewing underside and the red sub-basal spot of the hindwing underside.

The *nigrina* and *belisama* groups lack the consistent morphological features observed in most of Talbot's groupings, thus making the assignment of species to these groups more difficult, based solely on morphology. Therefore, while the present authors retain some reservations about the allocation of *D. shunichii* to the *nigrina* species group, there appear to be some grounds for retaining the present arrangement. The availability of additional male specimens will now enable the study of genitalia and androconial form, which will help establish the true position of *D. shunichii* within *Delias*.

As yet nothing is known of the life history of *D. shunichii*, but it is likely that its larvae feed on mistletoe (Loranthaceae), as is common and well documented for many species of *Delias*. Nor is it known whether it is a montane species appearing only rarely at lower altitudes, or if its habitat is in some other way restricted, but for whatever reason it is rarely encountered.

### Acknowledgements

The authors thank Shane Dyke for providing the translation of the Morita paper from Japanese, Dr G. (Fred) Gerritts for bringing the Morita paper to our attention and Chris Müller for reviewing the manuscript.

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# A NEW SUBSPECIES OF *CROITANA ARENARIA* E. D. EDWARDS (LEPIDOPTERA: HESPERIIDAE) FROM EYRE PENINSULA, SOUTH AUSTRALIA

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## Abstract

*Croitana arenaria pilepudla* subsp. n. is described from northern Eyre Peninsula, South Australia. Adults and male genitalia are illustrated and compared with nominotypical *C. arenaria* E.D. Edwards from central Australia.

## Introduction

The genus *Croitana* Waterhouse presently contains three species, *C. aestiva* E.D. Edwards, *C. arenaria* E.D. Edwards and *C. croites* (Hewitson), (Edwards 1979, Braby 2000). Since 1987 (Moore 1988) adult *Croitana* have been known from northern Eyre Peninsula, South Australia, and assigned to *C. arenaria* (Braby 2000). These adults are 550 km removed from known central Australian populations of *C. arenaria* (Grund and Hunt 2001), are morphologically distinct and warrant subspecific status.

Depositories are abbreviated as follows: SAM - South Australian Museum, Adelaide; RG - collection of R. Grund, Adelaide; LH - collection of L. Hunt, Adelaide.

## *Croitana arenaria pilepudla* subsp. n.

(Figs 1-4)

*Types.* *Holotype* ♂, SOUTH AUSTRALIA: Botenella Hills, northern Eyre Peninsula, 20.ix.1999, R. Grund (in SAM). *Allotype* ♀, Botenella Hills, northern Eyre Peninsula, 9.x.2000, R. Grund (in SAM). *Paratypes*: 1 ♂, Botenella Hills, 4.x.1987, M. Moore (SAM); 1 ♂, Botenella Hills, 9.x.2000, R. Grund, genitalia dissected, (RG); 1 ♂, Botenella Hills, reared ex egg emerged 4.i.2001, L. Hunt, genitalia dissected, (LH); 1 ♂, Botenella Hills, reared ex egg emerged 9.i.2001, L. Hunt (LH); 1 ♂, Botenella Hills, reared ex egg emerged 16.i.2001, L. Hunt (LH); 1 ♀, Botenella Hills, 9.x.2000, R. Grund (RG); 1 ♀, Botenella Hills, 9.x.2000, L. Hunt (LH).

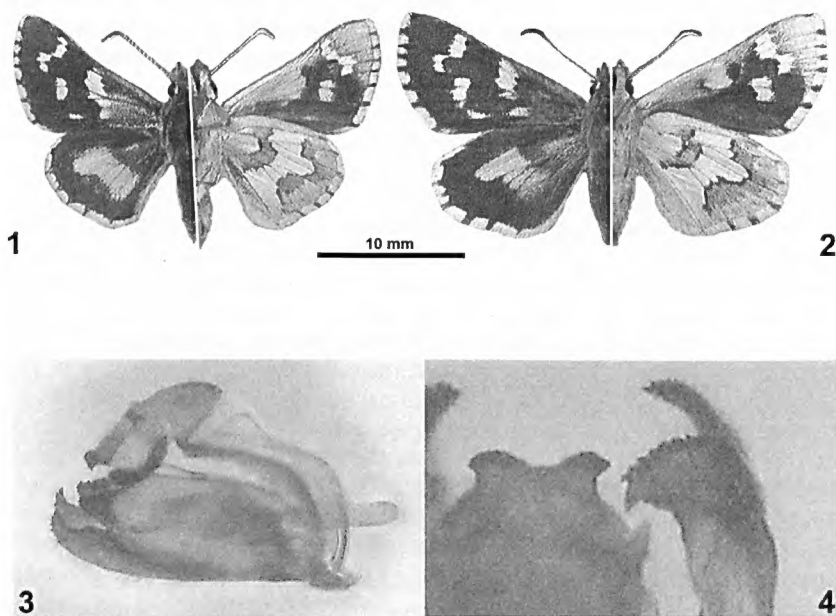
*Description.* *Holotype* male (Fig. 1); Body above dark yellowish brown with posterior part of abdomen ringed pale yellow, beneath pale yellow, legs pale yellow, fore-leg with short epiphysis, hind tibia without median spurs; antennae dark above with shaft ringed pale yellow, beneath pale yellow, club bent before the middle, apiculus blunt, nudum brown, 12-13 segmented. Forewing 15 mm, apically pointed, costa concave in the middle, termen slightly convex, tornus obtuse, dorsum straight, hindwing rounded. Forewing upperside dark brown, basal one-third with scattered pale yellow scales merging distad with an irregular submedian row of large, nearly confluent pale yellow spots extending from space CuA<sub>2</sub> to nearly the costa, the spots being separated by dark veining, the spot in space CuA<sub>2</sub> is divided longitudinally in the middle, the spot in the cell is the largest and extends to



near the end of the cell, the basad portion is mostly free of the basal dusting of pale yellow scales, the portion next to the cubitus extending slightly basad, there are three subapical confluent pale yellow spots extending from veins  $R_3$  to  $M_1$ , two subterminal confluent pale yellow spots distal to the subapicals but just touching, extending from veins  $M_1$  to  $M_3$ , two confluent pale yellow postmedian spots extending from  $M_3$  to  $CuA_2$ , and an additional small postmedian elongated pale yellow spot anterior to vein  $1A+2A$ , cilia pale yellow chequered dark brown at tips of veins. Hindwing upperside dark brown with some scattered yellow hair scales basally, a small subbasal elongated orange cell spot, a large postmedian orange patch extending from anterior of vein  $M_1$  to vein  $1A+2A$ , the inner edge is nearly straight, the outer edge is significantly extended distally in spaces  $M_1-M_2$  and  $CuA_2$ , the extension at spaces  $M_1-M_2$  is confluent and extends into the subterminal area and is rounded distally (not divided), cilia pale yellow chequered dark brown at tips of veins. Forewing underside dark brown, apex pale yellow the intensity of the colour increasing apically, the costal edge is yellow, the subapical and subterminal spots distributed and coloured as on the upperside, spots between  $M_3$  and  $CuA_2$  orange, cell area orange distally yellowish, the orange area extending slightly posterior of the cubitus, a heavy dusting of orange scales anterior of vein  $1A+2A$  and an indistinct postmedian elongated orange spot anterior to vein  $1A+2A$  as on upperside, cilia pale yellow chequered dark brown at tips of veins. Hindwing underside with the basal area, the costal area, and the distad part of the anal area ( $1A+2A$  and  $3A$ ) pale yellow, the basad part of the anal area is dusted with black scaling, a large subbasal pale yellow spot edged dark brown distad in the cell and space  $Sc+R_1$ , a confluent submedian band extending from  $Sc+R_1$  to  $1A+2A$  dark brown with a heavy dusting of yellow scales, a confluent postmedian band pale yellow indistinctly narrowly edged dark brown extending from  $Sc+R_1$  to  $1A+2A$ , the inner edge generally curved but with a noticeable extension basad in space  $Sc+R_1$ , the outer edge is strongly elongated distad into the subterminal area in spaces  $M_1-M_2$  and to the terminal area in space  $CuA_2$ , the distal end of the  $M_1-M_2$  elongation is rounded (not divided), an incomplete subterminal band of dark brown with a heavy dusting of yellow scales, that area distad in space  $M_1-M_2$  extending into the terminal area, a broad terminal band of very heavy pale yellow scaling overlaying brown (except in the  $M_1-M_2$  space), cilia pale yellow narrowly chequered dark brown at tips of veins.

Allotype female (Fig. 2). Similar to the male. Nudum 13 segmented. Forewing 17 mm. Forewing above similar to male with the spots better developed, except for the spot in space  $CuA_2$  of the submedian row of spots which is strongly divided with the portion anterior of vein  $CuA_2$  being elongated and better developed than in the male, the basal dusting of yellow scales is also less developed than in the male causing the inner edged of the submedian row of pale yellow spots to be well defined. There is an additional small postmedian spot posterior to vein  $CuA_2$ . Hindwing above similar to the

male, except the orange patch is more clearly defined anteriorly and does not extend beyond vein  $M_1$ , while posteriorly it is not as well defined and becomes obscured before reaching vein  $1A+2A$ , the veins  $M_3$ ,  $CuA_1$  and  $CuA_2$  crossing the patch are marked dark brown, the distad edge of the patch is slightly indented at each vein that passes through the patch. Forewing beneath markings similar to the male, but without a dusting of yellow scales anterior of vein  $1A+2A$ . (The additional small yellow spots present above in the female do not occur beneath.) Hindwing beneath similar to the male except the edges of the postmedian band are clearly edged dark brown, and the distal edge of the band is slightly indented at each vein that passes through it.



**Figs 1-4.** *C. a. pilepudla* subsp. n. (1-2) Upper and undersides of: (1) holotype male and (2) allotype female; (3-4) Male genitalia: (3) side view complete and (4) dorso-posterior view of ampulla, harpe and uncus.

**Male genitalia** (Figs 3-4). Robust; combined tegumen and uncus hood-shaped, shorter than valvae with uncus directed down into valval cavity; tip of uncus strongly sclerotized and hairy, divided and produced into two bluntly pointed projections with very short teeth; flattened sclerotized dorsolateral lobes present at anterior end of uncus; gnathos region developed into large

paired bulbous pads, each pad divided into a smooth and strongly sclerotized anterior portion that is flattened basally and a posterior portion with the anterior part of the lower surface strongly sclerotized and granular, and the posterior part non-sclerotized. Vinculum curved; saccus short and broad. Valva with well developed ampulla and harpe; harpe sclerotized, about one-quarter the size and longer than the ampulla, distal portion very hairy and covered in fine teeth; at about two-thirds along harpe from ampulla junction the harpe narrows markedly ending in a flattened scimitar shape that curves dorsally and inwards and ends in a point; distal portion of ampulla strongly sclerotized, hairy, constricted, flattened, twisting to the horizontal posteriorly, the leading edge with inwardly directed fine teeth with the end of the ampulla ending with a single large spine that is directed anteriorly. Aedeagus long, simple; coecum well developed; post zonal area slightly broadened posteriorly; prezoal area of similar diameter; seminal duct enters dorsally. Juxta well developed beneath the aedeagus as a short V-shaped sclerotized plate.

*Variation.* In the paratype males there may be an additional small postmedian spot posterior to vein  $CuA_2$  on the forewing upperside. The large postmedian orange patch on the hindwing above may start at  $M_1$ , and the extension in spaces  $M_1$ - $M_2$  may rarely have a slight indentation as in the female. The same elongation of the postmedian band in spaces  $M_1$ - $M_2$  on the hindwing beneath may be squared or rarely have a slight indentation. In two of the reared males the dusting of pale yellow and yellow scales in the subterminal and terminal areas of the hindwing beneath is so heavy as to make these areas confluent. In another reared male the dusting of pale yellow and yellow scales in the same areas is minimal causing the brown colour to be confluent from the postmedian band to the termen. (Note: The colouration of the reared males may be an artifact as they emerged outside the normal? flight period.) In the paratype females the small spot posterior to vein  $CuA_1$  of the postmedian area on the forewing upperside may be absent and the subapical and subterminal spots may not be touching. There may be a dusting of yellowish scales anterior of vein  $1A+2A$  on the forewing underside, and the postmedian band in the hindwing underside may not be clearly outlined with dark brown. In both sexes, with ageing from flight, the orange colour above becomes yellow and the dark brown submedian and subterminal areas on the hindwing beneath become much more obvious, with the extension at the distal portion of  $M_1$ - $M_2$  noticeably extending to near the termen. The nudum of the antennae varies from 12 to 14.

*Etymology.* 'Pilepudla' is the local aboriginal name for a water hole in the Botenella Hills area of the Eyre Peninsula, South Australia.

*Distribution.* Presently known from only two small areas on northern Eyre Peninsula, South Australia. Adults and early stages are known from the Botenella Hills and adjacent areas, while only early stages are known from



the south end of the Middleback Ranges. The species has been observed in flight from late September to early October.

### Discussion

*Croitana arenaria pilepudla* is generally much larger than nominotypical *C. a. arenaria*. The overall pattern morphology of the two subspecies is similar, but they can be easily differentiated by the pattern on the hindwing underside, particularly the shape of the pale yellow postmedian band. In *C. a. pilepudla* the distal extensions of the postmedian band in spaces  $M_1$ - $M_2$  and  $CuA_2$  are much more obvious. In *C. a. arenaria* (Edwards 1979) the dark brown veinal indentations along the distal side of the postmedian band are much better developed than in *C. a. pilepudla*, producing a double-pronged pattern at  $M_1$ - $M_2$ , which is usually rounded or squared in *C. a. pilepudla*. The pale yellow terminal spots of the hindwing beneath in *C. a. arenaria* are not developed in *C. a. pilepudla*, being replaced by a heavy terminal dusting of pale yellow scaling. In *C. a. arenaria* the yellow markings on the forewing above are usually much better developed than in *C. a. pilepudla*. There are also some differences in male genitalia, particularly the valvae. In *C. a. pilepudla* the genitalia are more robust and generally wider. The combined tegumen and uncus is wider, the saccus is wider, and the coecum of the aedeagus is more robust. The harpe of the valva does not gradually taper posteriorly as in *C. a. arenaria* (Edwards 1979) but narrows abruptly along its length, and the posterior end of the harpe is not as strongly constricted as in *C. a. arenaria*. The ampulla of the valva is more broader posteriorly and the teeth at the end of the ampulla are much smaller and more numerous than in *C. a. arenaria* and ends in a single large spine that is directed anteriorly (Fig. 4) in contrast to *C. a. arenaria* in which the final spine is directed inwards (rather than anteriorly).

*C. a. pilepudla* differs from *C. aestiva* and *C. croites* in that the postmedian band on the hindwing underside is not strongly displaced basad in space  $Sc+R_1$ .

*C. a. pilepudla* represents an isolated subspecies of *C. arenaria*. The nominotypical subspecies is probably confined to central Australia, including the far northwest region of SA (Grund and Hunt 2001) and the Macdonnell Ranges region (Braby 2000). These two subspecies are separated by hot, dry, low rainfall areas where the foodplant appears to be unable to survive or maintain green growth for any extended period of time (Grund and Hunt 2001).

Since the initial discovery of *C. a. pilepudla* by M. Moore the author has been successful in collecting further specimens and documenting its life history (Grund 1999, Grund and Hunt 2001). The adult skipper is very secretive and therefore not often seen in flight. During the adult flight season, the presence of eggs is often the only means of detecting the skipper. When observed, both sexes are usually seen feeding on low growing flowering bushes of

*Westringia rigida* (Lamiaceae). Males are sometimes seen basking in the sun on the hillsides, down from the hilltops.

There have been suggestions by other scientists that *C. a. pilepudla* may represent a distinct species, but to resolve this question would require allozyme or DNA analysis, which is beyond the scope of this study.

### Acknowledgements

I thank Lindsay Hunt and Mike Moore for help with field survey work.

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## A NEW SPECIES OF *CERATITELLA* MALLOCH (DIPTERA: TEPHRITIDAE: CERATITIDINAE) FROM THE SOLOMON ISLANDS

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### Abstract

*Ceratitella solomonensis* sp. n. is described and illustrated from Guadalcanal, Solomon Islands.

### Introduction

The fruit fly genus *Ceratitella* Malloch contains nine previously described species, distributed from the Ryukyu Islands, China and Pakistan to Australia (Permkam and Hancock 1995, Hancock and McGuire 2002), plus an unnamed species from the island of New Guinea (Hardy 1987). Recent fieldwork in the South Pacific has yielded a further new species, from the Solomon Islands.

### *Ceratitella solomonensis* sp. n.

(Figs 1-2)

*Types. Holotype* ♀, SOLOMON ISLANDS: NE Guadalcanal, Lonely Village, 8.viii.1994, R. Wylie *et al.*, SI 0078 (in Queensland Museum, Brisbane; Reg. No. T 99077). *Paratypes*: 1 ♂, 2 ♀♀, same data as holotype (in Queensland Department of Primary Industries, Brisbane).

*Description.* Female (Fig. 1). Length of body (excluding ovipositor) 4.6 mm; of wing 4.8 mm. Head higher than long. Face broad, entirely white. Antennae yellow, shorter than face, situated near middle of head; third segment apically rounded; arista with short pubescence. Frons fulvous. Lunule short, yellow. Occiput fulvous. Setae black: 2 pairs of frontals; 2 pairs of orbitals; ocellars, postocellars and verticals well developed; postoculars thin; genal well developed.

Thorax. Scutum polished black with a large, grey-dusted, white-microtrichose area covering most of dorsal surface from just anterior to suture to prescutellar area, leaving shining black areas anteriorly, laterally and as broad dorsolateral indentations anterior to dorsocentral setae; the greyish band along anterior margin of suture connected to the posterior area by a broad medial band; posterior greyish area darker along medial and dorsocentral lines. Postpronotal lobes yellow dorsally, brown on ventral half. Setae black: 4 scapulars, 1 postpronotal, 1 anterior notopleural, 1 presutural, 1 posterior notopleural, 1 supra-alar, 1 postalar, 1 intra-alar, 1 pair of dorsocentrals placed on line of supra-alars, 1 pair prescutellar acrostichals. Pleura brown, paler along dorsal margin of anepisternum and with a narrow white band along posterior margin of anepisternum; with the following setae: 1 anepisternal, 1 anepimeral, 1 katepisternal. Scutellum shining black and



swollen, with 4 scutellar setae and fine sparse pale setulae. Subscutellum black. Mediotergite black, overlaid with greyish-white microtrichia. Legs fulvous except brown on mid and hind femora, apical half to two-thirds of fore femora and basal half to two-thirds of hind tibiae; middle tibia with an apicoventral black spine.

Wing hyaline with dark markings as follows: basally and with numerous spots and streaks from cell c to cell bcu; three bands radiating from pterostigma: a broad costal band extending almost to vein M apically, with narrow hyaline streaks or indentations along costa in cells  $r_1$  and  $r_{2+3}$  and as subcostal streaks in cell  $r_1$  covered in dark microtrichia; a broad discal band reaching wing margin below vein  $A_1+Cu_2$ ; a subapical band enclosing R-M and DM-Cu crossveins. A fourth, posterior apical band, extends from costal band to wing margin in cell M. Cell  $r_1$  with two darker transverse bands submedially, between the hyaline streaks. Alula and basal part of anal lobe hyaline. Veins  $R_1$  and  $R_{4+5}$  setose; vein  $R_{2+3}$  undulate; R-M crossvein slightly beyond middle of cell dm, aligned just beyond apex of cell sc; cell bcu extension well developed and with vein  $Cu_2$  sinuous.

Abdomen black with greyish-white microtrichose bands on posterior parts of terga I+II, III and IV. Tergite VI very narrow, not visible from above. Oviscape black, subquadrate, length 0.5 mm, as long as tergite V. Aculeus (Fig. 2) relatively broad, distinctly tapered apically, length 0.48 mm.

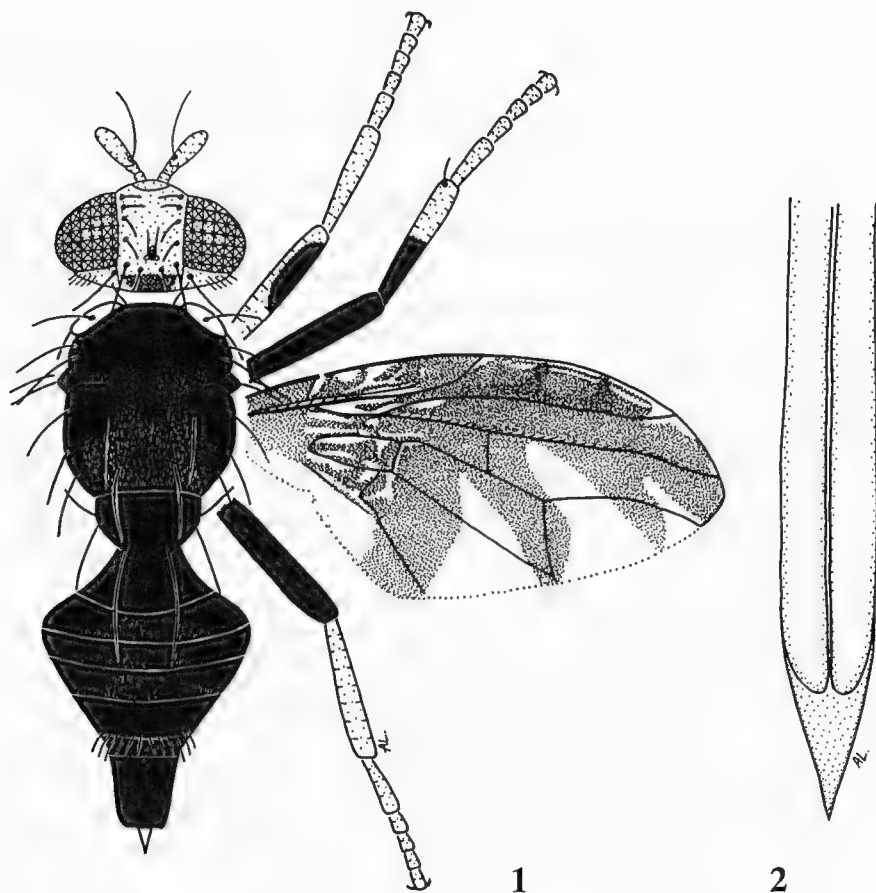
Male. As for female except genital characters, which are typical of the genus (Hardy 1987).

*Host plant.* Unknown. The type series was bred from an unidentified fruit.

*Distribution.* Known only from Guadalcanal, Solomon Islands.

*Comments.* This species is placed in the *bifasciata* complex (Permkam and Hancock 1995), having a similar wing pattern with a complete posterior apical dark band. It differs from all other species in the complex by the more extensive greyish-white scutal pattern, the anterior and posterior portions being broadly connected medially (separated by a shining black transverse band in the other species). The aculeus resembles that of the unnamed New Guinea species (Hardy 1987), lacking the apical notches of *C. bifasciata* Hardy and being broader and more sharply tapered apically than in *C. recondita* Permkam & Hancock. The latter two species both occur in Australia. All recorded host plants for the genus are species of mistletoe (Loranthaceae).

*Ceratitella solomonensis* is the third species of subfamily Ceratitidinae recorded from the Solomon Islands. The others, *Carpophthorella nigrifascia* (Walker) (= *C. setifrons* Malloch) and *Paraceratitella connexa* Hardy, are presumed to breed in bamboo shoots and flower buds of Capparaceae respectively (Permkam and Hancock 1995).



Figs 1-2. *Ceratitella solomonensis* sp. n. (1) female; (2) aculeus.

### Discussion

*Ceratitella* belongs to a small group of Indo-Australian genera with similar wing markings and extensive pale microtrichose patterns on the scutum. The other genera are *Neoceratitis* Hendel from central Asia and Africa (host plants Solanaceae) and *Paratrithrum* Shiraki from Taiwan (host plants unknown). This group in turn appears to be related to the primarily African genera *Ceratitis* MacLeay (host plants very diverse) and *Capparimyia* Bezzi (host plants Capparaceae). In all the above genera the wing has an extensive series of basal spots and streaks and cell  $r_1$  tends to have a pair of submedial darker spots or transverse streaks within the dark pattern. *Paraceratitella* Hardy from Australia, Papua New Guinea and Solomon Islands (host plants

Capparaceae), appears to be a more primitive genus related to both these groups. This genus lacks the extensive series of basal wing spots and streaks and the darker spots in cell  $r_1$  are differently arranged (basal and/or central).

*Ceratitis* appears to be more distantly related to the African genus *Perilampus* Bezzi, which also breeds in Loranthaceae, suggesting that utilisation of mistletoe has occurred independently in the two groups. *Perilampus* appears to be more closely related to other African genera such as *Nippia* Munro, *Carpophthoromyia* Austen and *Trirhithrum* Bezzi. In these genera the wing lacks the extensive series of spots and streaks and cell  $r_1$  tends to be uniformly brown without the darker spots.

### Acknowledgements

We thank Amy Lawson (Griffith University) for preparing the illustrations. Field work in the Solomon Islands was carried out under ACIAR project No. CS2/94/03 'Identification of pest fruit flies in Vanuatu, Solomon Islands and Federated States of Micronesia' and the Regional Management of Fruit Flies in the Pacific project.

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## CD-ROM REVIEW

**ThripsID:** Pest Thrips of the world, by Gerald Moritz, David Morris & Laurence Mound. Publisher: CSIRO Publishing. Format: CDROM, suitable for Windows 95/98/ME/2000 and Xp. Minimum requirements: 32 MB Ram, 16 bit colour or higher (SVGA), CDROM drive 20 MB HDD. Browser supplied: IE 5.0 and Mozilla. Price: \$A80

Released in 2001, this CDROM interactive key covers identification of the world's economically important thrips. From the outset I struggled with both the formatting and packaging of this product. The CDROM is distributed in a DVD case and I nearly broke the CD trying to get it out of the case, primarily due to my unfamiliarity with this form of packaging. Having figured out that you have to press the button to get the CD out I then discovered that this CD has the dubious honour of being only the second CD that my CDROM refuses to read (both were from CSIRO Publishing). So after copying it from another CDROM and burning a new copy I finally ended up installing and running ThripsID.

Installation and operation of the program was very easy on the 95, 98 and Xp machines I tried it on. The interactive key uses Lucid (ver. 2.0) software and browser software (if browser software is not already present on the users machine, the user can install either Netscape or Internet Explorer (ver. 5) as they are also included with this package). I do note with some interest that Lucid now runs ver. 2.1 (<http://www.lucidcentral.com>) but this version update had no impact on the performance of this key.

I find the operation of Lucid keys particularly intuitive and easy to use due to prior experience with them and this coloured my judgement on the operability of this key. I gave a non-taxonomist a thrips slide and asked them to 'have a go' with the key and interestingly they stumbled on the interactive tutorial that is included with this key. The tutorial has very clear text descriptions of what users can expect to see on the screen which did not immediately translate to this user recognising these features on the screen. It was a little ironic that such a commendable, graphics-orientated program uses so little graphics in the tutorial to illustrate the buttons, windows and other features that it mentions in the tutorial text. Having said that the tutorial did adequately cover all the salient features required for first time users in a simple, concise, step by step fashion and once the tester figured out what was what we had an identification in a short time. Extensive and well illustrated 'Help' is provided with Lucid and although there is a provision for a 'Custom Help' feature none is available for the ThripsID package.

Once the user has mastered Lucid, the operation of the key is very easy to use with almost all taxa and character states being supported by, often multiple graphics and explanatory notes. More than 1500 excellent colour and B & W photomicrographs are used in the key and these are mostly derived from the "Automontage" imaging system which gives users a 'what you see is what you get' view of characters and taxa. These images appear as they would were you to look through a microscope but with a far greater depth of field. The authors have used the macro facility of Lucid to help highlight some character states which I found extremely useful in some instances and a bit of a waste of time for some other images. The macro feature, when run, moves a mouse cursor over the image to, or around, the character you wish to illustrate. In

some instances annotation of the images may have been easier to interpret than the macro, for example antennal segment numbers - a simple numbering of the segments would have sufficed. Similarly an image of the forked sense cones on antennal segments III and IV was illustrated with an image showing III and all subsequent antennal segments and the novice who trialed the key in my presence thought that the image started at antennal segment I.

The key covers 180 species in 95 genera and includes representatives from all 9 known families with the taxa representing most of the major and minor thrips pest species recorded widely around the world. ThripsID works by firstly providing a key to families which ultimately then cascades to a subfamily key and/or then to a species level key. Detailed and generous notes and illustrations are provided for diagnoses for each family, subfamily and species mentioned in the key.

Notes supplied for each taxon usually include morphological diagnosis, nomenclatural details, food hosts, economic importance, distribution, generic relations and related species. References are mentioned within the text but I could not find where these are listed. It is a pity that these references could not be independently searched using something like 'Custom Help'. This would also allow these references to be cross-linked in the text. A particularly useful feature of this key is the provision of a 'netsearch' feature which races off to a variety of WWW search engines and searches for info on the currently selected taxon. A 'netsearch' of *Thrips tabaci* returned a long list of useful sites and at least a few oddities. I did search the returned CNN Sports site and two EBay Disney Auction sites but strangely could find no trace of any *Thrips tabaci* information.

I firmly believe that the plentiful use of good graphics to illustrate characters and taxa in place of, or in addition to, text within a key will vastly improve any key's useability and this key provides an excellent example of how this can best be done. The abundant use of graphics is of particular importance where the 'clients' may not be taxonomic specialists. This product with its ease of use, rich support of excellent graphics and information is primarily aimed at research workers, quarantine officers and economic entomologists and will undoubtedly become an essential tool for such folk. Some virologists, parataxonomists and students may also find this key very useful and I would highly recommend it to any person interested in the Thysanoptera.

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## A NEW GENUS AND SPECIES OF PENTATOMIDAE (HEMIPTERA: HETEROPTERA) FROM NORTHERN AUSTRALIA

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*Department of Crop Sciences, University of Sydney, NSW 2006*

### Abstract

*Linea griggae* gen. et sp. n. from Western Australia, Queensland and the Northern Territory is described and figured. The genus is related to *Cephaloplatus* White. No host plant records are known.

### Introduction

A distinctive new genus of Pentatomidae is recorded from the Northern Territory, Queensland and Western Australia. Adults are oval, greyish brown with distinctive cream and dark brown stripes on the dorsal surface. The lateral margins in front of the eyes are produced into a distinct spine also found in *Cephaloplatus* White. There are no records of host plants. Specimens appear to be attracted to light and have even been collected 9.65 km out to sea.

### Materials and methods

All measurements are in millimeters. The body width is taken as the width across the base of the pronotum and the length is from the apex of the head to the tips of paratergites 7. Terminology used follows McDonald (1966) and Gross (1975). Abbreviations used are: ANIC, Australian National Insect Collection, CSIRO, Canberra; MM, Macleay Museum, University of Sydney; WAM, Western Australian Museum, Perth.

### *Linea* gen. n.

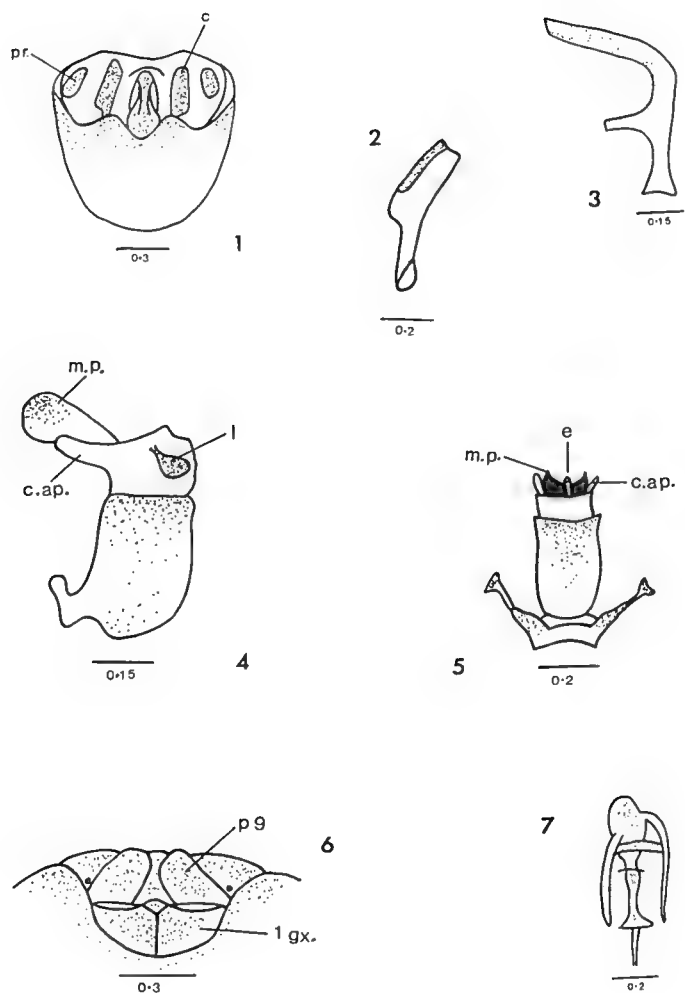
(Figs 1-8)

Type species *Linea griggae* sp. n.

*Description.* Head. Two small projections found, one on either side of eyes, jugae flattened and broad surpassing tylus. Antennae. All segments with a number of short hairs; one and two short, three longest, four and five equal in length. Thorax. Prothorax with lateral margins impressed. Legs. Femora, tibiae and tarsi covered with short hairs. Mesosternum. Stink gland opening small ear-like; evaporative area covering most of sternum.

*Male genitalia* (Figs 1-5). Dorsal margin broadly arched. Ventral margin bilobed with a central emargination deeply impressed behind margin. Inner lateral margins with two peg-like processes one on each side. Parameres large F-shaped. Aedeagus very small, when expanded one pair of membranous conjunctival appendages, lappet processes present one on each side. Median penial lobes very small plate-like enclosing a very short ejaculatory duct.

*Comments.* This genus is a member of the *Cephaloplatus* group (Gross 1976) by virtue of the fact that the jugae surpass the anteclypeus and are flattened.



**Figs 1-7.** *Linea griggae* (1) pygophore; (2) right clasper, lateral; (3) right paramere, inner view; (4) aedeagus, lateral; (5) aedeagus, dorsal; (6) female genital plates; (7) spermatheca. Abbreviations: c, clasper; c.ap., conjunctival appendage; e, ejaculatory duct; 1 gx., first gonocoxa; l, lappet process; m.p., median penial lobe; p9, paratergite 9; pr., process.

*Linea* can readily be distinguished from *Cephalaplatus*, which has the anterior margins produced forward as an angulate process to the anterior margins of the eyes, since in *Linea* the margin is not produced. The male genitalia are quite distinct from those of *Cephaloplatus reticulatus* Bergroth (Gross 1975). The parameres are T-shaped in *C. reticulatus* whereas in *Linea* they are F-shaped. The aedeagus in *Linea* is also distinct, having very small conjunctival appendages, whereas in *C. reticulatus* they are quite large and inflatable.



Fig. 8. *Linea griggae*, adult female.

***Linea griggae* sp. n.**

(Figs 1-8)

*Types.* Holotype ♂, WESTERN AUSTRALIA: North West Cape, 22.vii.1964, L.E. Koch (WAM). Paratypes: 1 ♂, 1 ♀, Cape Range, iv.1970, P.N. Forte; 4 ♂♂, 14 ♀♀, North West Cape, 21.vii.1964, L.E. Koch (WAM).



*Other material examined.* WESTERN AUSTRALIA: 1 ♂, 1 ♀, Port Hedland, 9.65 km out to sea, R. Easton, (WAM); 1 ♂, 7 ♀♀, Ashburton River, 30.viii.1964, P.B. Carne; 1 ♀, Wyndham, 12.ii.1953, G. Lukins, (ANIC). QUEENSLAND: 1 ♀, Limestone Creek, 22°35'S, 139°43'E, 42 km NNW of Boulia, 11.v.1973, Upton and McInnes (ANIC). NORTHERN TERRITORY: 1 ♂, 1 ♀, 4.8 km S. of Renner Springs, 8.iv.1966, N. McFarland; (SAM) 1 ♂, 7 ♀♀, Tennant Creek, 23.i.1976, J. Grigg (MM).

*Description* (Fig. 8). Head. Buff coloured with dark brown punctations. Thorax. Prothorax - dorsal surface buff coloured, lateral margins impressed, cream; broad dark brown bands running adjacent to lateral margins, dark brown spot centrally. Mesoscutellum with 3 cream stripes one on each lateral margin and one centrally, separated by dark brown bands. Hemelytra buff coloured with a narrow cream band running the length of medial fracture with a dark brown band running along inner side, basally broad tapering towards base of each hemelytron. Membrane grey-brown. Pro-, meso- and metasterna amber with dark brown punctations and brown bands around coxal bases. Legs buff coloured. Abdomen. Sterna with a broad buff band with brown punctations along lateral margins, centrally dark brown with pale patches in middle of sterna 4, 5 and 6. Spiracles outlined in black. Female genitalia (Figs 6-7). First gonocoxae, broad plate-like with a narrow impression along anterior margins. Second gonocoxae with a small central knob at junction with first gonocoxae. Paratergites 9 broad spatulate. Spermatheca very similar to *Minchamia hubbardi* Gross (Gross 1975); spermathecal bulb with 2 long processes. Male genitalia (Figs 1-5) as for generic description.

*Measurements.* Male (n = 10): length 6.9 mm (range 7.2-6.5); width 3.6 mm (range 3.7-3.4). Female (n = 34): length 7.8 mm (range 8.2-7.0); width 4.0 mm (range 4.1-3.4).

*Etymology.* *Linea* from latin, a line, referring to the stripes on the scutellum and *griggae* after Jan Grigg, collector of several specimens.

### Acknowledgements

I thank the following curators and institutions for the loan of specimens: T. Weir, ANIC; Dr G.F. Gross, SAM; Dr T.F. Houston, WAM.

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# A NEW SPECIES OF *MYNES* BOISDUVAL (LEPIDOPTERA: NYMPHALIDAE) FROM THE MOLUCCAS, INDONESIA

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## Abstract

*Mynes obiana* sp. n. is described from the Moluccan island of Obi, eastern Indonesia.

## Introduction

The genus *Mynes* Boisduval, [1832], contains approximately ten described species, ranging in distribution from the island of Flores and through Maluku (Moluccas) in Indonesia, to eastern Australia and the Solomon Islands (D'Abrera 1978, Parsons 1998, Tsukada 1985). Four of these species are known to occur in Maluku (Fig. 1). *M. plateni* Staudinger, 1887, is found in Maluku Utara (northern Moluccas), including the islands of Bacan, Halmahera and Morotai, *M. talboti* Jurriaanse & Volbreda, 1922, occurs on Buru and *M. doubledaili* Wallace, 1869, flies on Seram. *M. geoffroyi* (Guérin-Ménéville, 1830), has a wider distribution, from southeast Maluku (Kei and Aru) and Gebe Island, eastwards to New Guinea and eastern Australia.

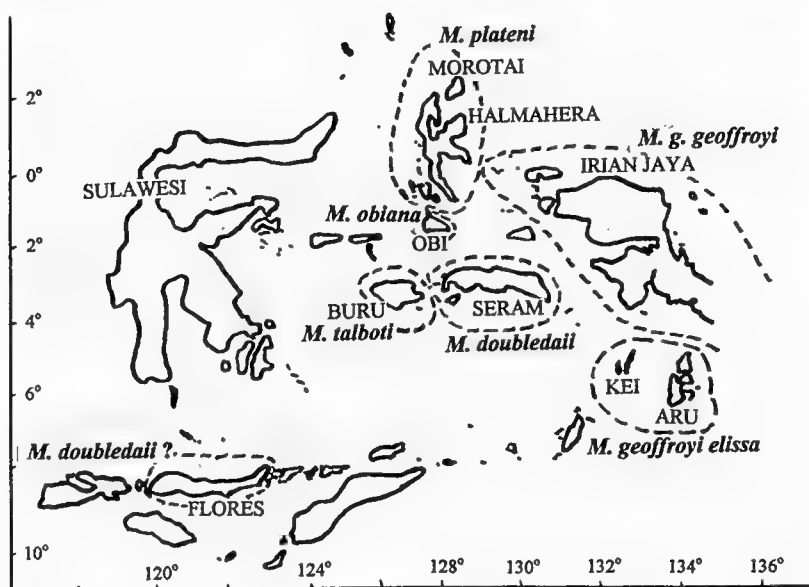


Fig. 1. Distribution of *Mynes* spp. in the Moluccan islands.

Two males, collected by the first author on the south coast of Obi in 1998, differ from any previously described *Mynes* taxon. The relatively large and isolated island of Obi lies between North and Central Maluku (Fig. 1) and, so far as the authors are aware, no *Mynes* species has been reported previously from this island.

***Mynes obiana* sp. n.**

(Figs 2-4)

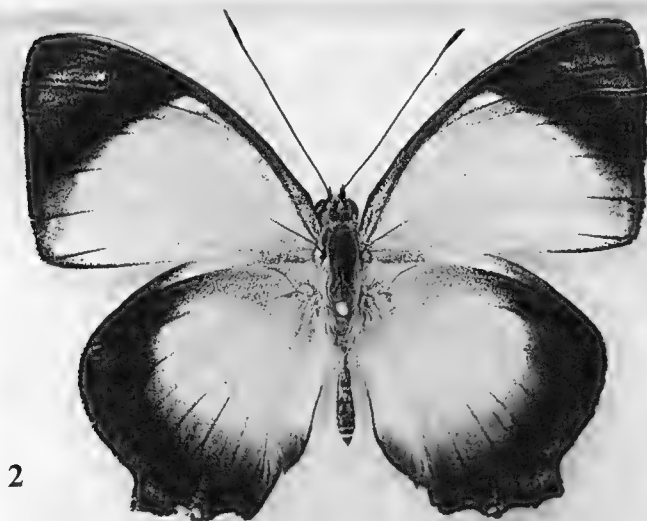
*Types.* Holotype ♂, INDONESIA: Maluku, Obi Island, south coast, Bobo village, 19.xi.1998, A. Rawlins (gen. prep. BMNH (V) 5981 [JT 718]), in The Natural History Museum, London [BMNH]. Paratype ♂, same data as holotype, in A. Rawlins Collection.

*Description.* Male (Figs 2-3). Forewing length 32 mm; upperside (Fig. 2) similar to *M. geoffroyi*; forewing basal two-thirds creamy-white, including tornus; apical third black, with obscure subapical white markings (in all subspecies of *M. geoffroyi* seen, a broad marginal border extends to tornus); like other *Mynes* species, creamy markings with peripheral, obscure bluish basal, tornal and costal markings; hindwing basal and discal areas creamy-white, suffused powder-blue basally; underside (Fig. 3) superficially similar to *M. g. elissa* Fruhstorfer, 1906; forewing with typical *Mynes* black, white and red markings; subapical irregular, broken line white (yellow in *M. g. elissa* [see discussion] and in nominotypical *M. g. geoffroyi* material seen from Irian Jaya); large white basal patch extending to tornus (broad marginal border extends to tornus in *M. geoffroyi* subspecies); hindwing with typical *Mynes* arrangement of black, red, green and yellow markings; extensive yellow patch (variable in extent in all *Mynes* taxa in which it occurs) similar in all respects in holotype and paratype, restricted in tornal area (extending almost to tornus in subspecies of *M. geoffroyi*). Female not known.

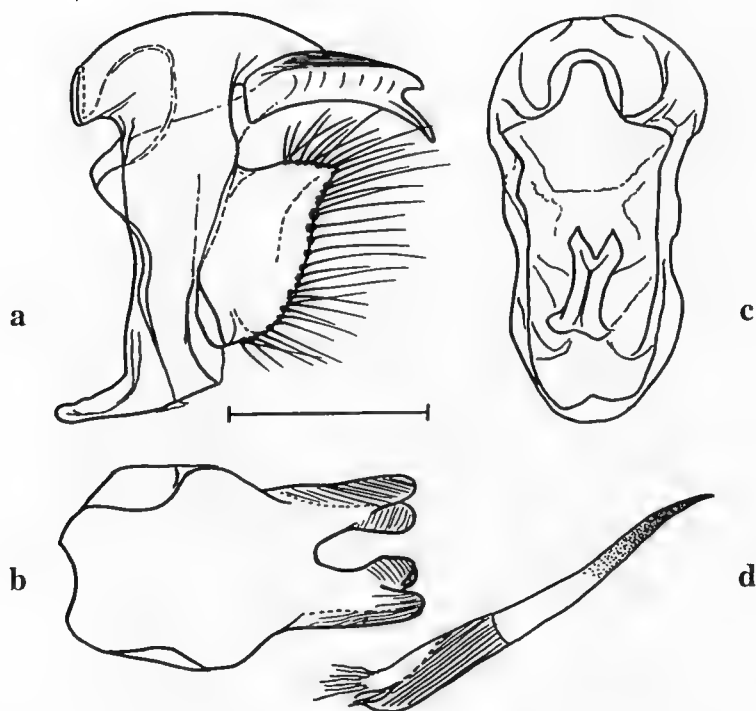
Male genitalia (Fig. 4). Similar to *M. geoffroyi*; tegumen with deep lateral indentation (lacking in specimens of *M. geoffroyi* examined); saccus well developed; valva large, angular (smaller, posterior edge more rounded in *M. geoffroyi*).

**Discussion**

*Mynes obiana* is closest in appearance to *M. geoffroyi elissa* Fruhstorfer, described from a solitary female originating from Wanumba Island in the Aru group. In The Natural History Museum, London [BMNH], there are a further three females from Aru, plus two females and a male from the Kei Islands. The first author recently obtained two males and one female from Kobroor Island in the Aru group. The female specimen matches Aru females in the BMNH and morphological differences, including the male genitalia, between *M. geoffroyi* subspecies and the Obi specimens described above suggest a new species.



Figs 2-3. *Mynes obiana* sp. n.; holotype male. (2) upperside; (3) underside.



**Fig. 4.** *Mynes obiana*, male genitalia. (a) left lateral view (aedeagus removed), showing exterior face of left valve; (b) anterior view, showing juxta (aedeagus removed); (c) dorsal view, showing tegumen and uncus; (d) excised aedeagus, left lateral view. Scale bar (all to same scale) = 1 mm.

### Acknowledgements

The authors thank R.I. Vane-Wright for the genitalia drawings and his help and advice and The British Museum (Natural History) Photo Studio for the genitalia photographs.

### References

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## A NEW SPECIES OF *PSILOPSOCUS* ENDERLEIN (PSOCOPTERA) FROM AUSTRALIA

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### Abstract

*Psilopsocus parvus* sp. n., the second Australian species of the genus, is described from Queensland. Its only Australian congener, *Ps. mimulus* Smithers, is known to be a wood borer in the nymphal stages. This unusual habit seems likely also in *Ps. parvus* but as nymphs are not available this cannot yet be confirmed.

### Introduction

Psilopsocids are extremely uncommon in collections and most of the seven known species have been described from very limited material. The genus is known from the Philippines, Manus Island, Papua New Guinea, Peninsular Malaysia and Australia. Nymphs of what is probably another species have been found in South Africa but adults which can be associated with them have not yet been recorded. The nymphs from South Africa show similar modifications to those of *Ps. mimulus* Smithers and are probably wood borers, as are those of *P. mimulus* (Smithers, 1995b).

A second Australian species of *Psilopsocus* is described here. Wood boring in this species cannot be confirmed as nymphs have not yet been found.

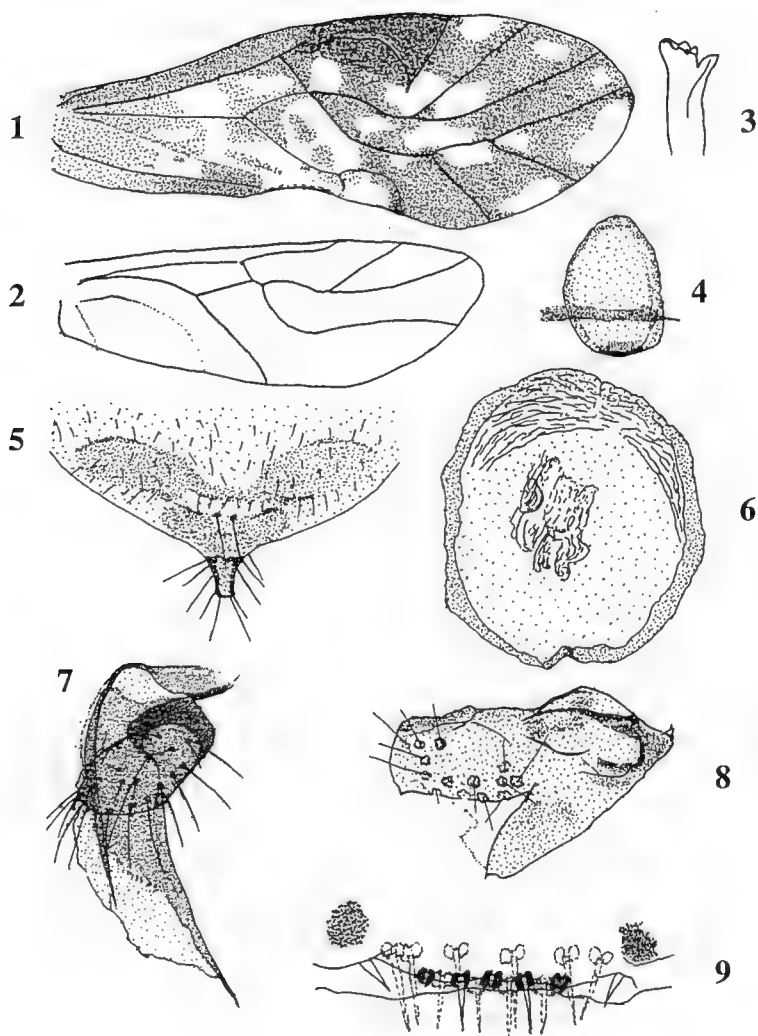
### *Psilopsocus parvus* sp. n.

(Figs 1-9)

**Material examined.** *Holotype* ♀, QUEENSLAND: ex Malaise trap, 11 km W. by N. Bald Hill, McIlwraith Range, 500m, 13.44S 143.20E, 26.vi-13.vii.1989, I.D.Naumann (in Australian National Insect Collection, Canberra). 1 ♂, Pyrethrin knockdown/RF, West Claudie River, Iron Range, 3-10.xii.1985, G.Monteith and D.Cook (in Queensland Museum, Brisbane). As this specimen was probably teneral when collected, is in poor condition and may not be conspecific with the holotype it should not be regarded as a paratype.

**Female.** *Colouration* (in alcohol). Head pale brown with darker markings as follows: Narrow patch along each side of median epicranial suture and across back of head and adjacent to compound eyes; a median V-shaped mark on frons anterior to ocellar tubercle. Postclypeus grey-brown with indistinct, parallel, longitudinal, brownish striae. Labrum dark brown. Scape and pedicel of antenna pale, first flagellar segment brown except for a short, pale length at base. Eyes black. Ocellar tubercle dark brown. Maxillary palp with first and second segments pale, third and fourth segments dark brown. Antedorsum of mesothorax brown anteriorly, paler posteriorly. Thoracic pleura mostly brown. Legs brown, only junction of femur and tibia of fore legs pale. Fore wings (fig. 1) with brown pattern. Hind wings (fig. 2) hyaline, very faintly tinged with brown. Abdomen pale with sclerotized terminal structures brown.





**Figs 1-9.** *Psilopsocus parvus* sp. nov. (1) Forewing; (2) Hindwing; (3) Lacinia; (4) Sclerotization of ninth sternite; (5) Subgenital plate; (6) Phallosome; (7) Gonapophyses; (8) Male paraproct; (9) Female labral sensilla.

*Morphology.* Length of body: 2.5 mm. Median epicranial suture very distinct. Vertex broadly rounded. Postclypeus not very prominent. Labrum with well developed anterolateral 'styli' and a small, pointed spur on inner side just mesad of position of usual lateral sclerotized patch on each side. Arrangement of anterior marginal sensilla as in figure 9. Length of first flagellar segment: f1: 0.50 mm. Eyes moderately large. IO/D: 1.3; PO: 0.6. Anterior ocellus smaller than lateral ocelli. Lacinia (fig. 3). Hind femur with ventral row of 14 fine setae. Measurements of hind leg: F: 0.49 mm; T: 0.93 mm; t1: 0.30 mm; t2: 0.05 mm; t3: 0.07 mm; rt: 6:1:1.4; ct: 13,1,1. Fore wing length: 2.9 mm. Fore wings glabrous. Pterostigma very wide at hind angle, which is very acute, with well developed spurvein. Broad, rugose, heavily sclerotized area of membrane present behind R<sub>1</sub> basad of spurvein. Pterostigma similarly rugose. Costal vein basad of pterostigma somewhat ill-defined, well defined as usual distad of stigmapophysis. Rs-M fusion very short in one wing of type, veins meeting almost in a point in the other wing. Veins in proximal part of wing less well defined than in distal half. Angle of Rs fork very small, opposite hind angle of pterostigma. Cu<sub>1a</sub> arises well away from wing margin, evanescent in basal half. Cu<sub>1b</sub> evanescent. Hind margin of wing a little thickened just basad of Cu<sub>1b</sub> junction with wing margin. Hind wing length: 2.1 mm. Hind wings glabrous except for one or two minute setae on margin between R<sub>2+3</sub> and R<sub>4+5</sub>. Rs and M fused for a length. Cu<sub>2</sub> and IA hardly discernible, the former more obvious near base. Epiproct (damaged in preparation) apparently simple, rectangular with posterior margin shorter than proximal margin, with a few large setae in distal half and some smaller setae in basal half. Paraproct triangular with large setae along and adjacent to hind margin, a few smaller setae scattered over posterodorsal third of the paraproct. Trichobothrial field ovoid, with about fourteen trichobothria, loosely placed over the field. Cuticle between 'basal rosettes' of the trichobothria reticulate. Subgenital plate (fig. 5, slightly tilted in preparation, dark areas symmetrical) with posterior lobe narrowed in distal half, with a sclerotized band along each side of narrowest part. Posterior lobe glabrous except for a median pair of long setae near base of wider part and a row of long, marginal setae on distal part of posterior lobe. Subgenital plate otherwise sparsely setose. Sclerotized area narrow medially, broader laterally. Sclerotizations of ninth sternite simple, weakly developed (fig. 4). Gonapophyses (fig. 7). Ventral valve finely pointed. Dorsal valve broad basally, narrowing abruptly to a fine point distally; lightly sclerotized except for a more heavily sclerotized, dorsal, longitudinal supporting edge which extends to form the distal point. External valve ovoid, with strong setae.

*Male. Colouration.* A single male from the West Claudie River appears to belong to this species. It had probably just undergone its final moult when it was collected. It was in poor condition and there was no colour pattern.

*Morphology.* Length of body not measurable. Length of flagellar segments: f1: 0.67 mm.; f2: 0.67. Eyes extremely large and prominent, almost abutting

ocellar tubercle on front of head. IO/D: 0.46; PO: 0.93. Ocelli very large and prominent. Measurement of hind leg: F: 0.54 mm; T: 1.04 mm; t1: 0.3 mm; t2: 0.05 mm; t3: 0.08 mm; rt: 6:1:1.6; ct: 11,1,1. Fore wings damaged. Hind wings lost. Paraproct (fig. 8, damaged in preparation) with trichobothria scattered over the large field, reticulation of cuticle between setae well developed. Posterior lobe of paraproct bearing a small, apical, pointed sclerite. Hypandrium rounded behind, with a large seta near middle of hind margin and smaller setae scattered over the hypandrium. A series of about nine very small setae protrude posteriorly along the middle section of the hind margin. Phallosome (fig. 6) almost circular, the parameres touching each other behind in the midline, the anterior margin of the ring with suggestion of median division. Outer parameres absent. Penial bulb membranous, wrinkled in a small part of the middle area but lacking any obvious sclerites.

### Discussion

*Psilopsocus mimulus*, the only previously described Australian species of *Psilopsocus* Enderlein, is remarkable for the fact that its nymphs are highly modified and adapted for life in tunnels which they bore longitudinally in twigs of the Australian native tree *Syncarpia glomulifera* (Smith) Niedenzu and introduced *Pinus radiata* D. Don. (Smithers 1963, 1983, 1995a, 1995b, 1997). The nymphs are cylindrical in general body form and the hindmost segments and terminal structures of the abdomen are greatly modified and heavily sclerotized, forming a hard plug which very effectively seals the lumen of the tunnel in which the nymphs spend most of their time (Smithers 1963, 1995a). The adults, however, are entirely bark-dwellers; they neither bore into wood nor show any obvious modification for life in tunnels.

*Psilopsocus parvus* is easily distinguished from *Ps. mimulus*. It is much smaller (fore wing length of *Ps. mimulus* is 5.4 mm, of *Ps. parvus* 2.9 mm) and in *Ps. mimulus* fore wing vein Cu<sub>1</sub> forks about half way between its separation from M+Cu<sub>1</sub> and the wing margin to give a much elongated areola postica of unusual shape whereas in *Ps. parvus* Cu<sub>1</sub> forks much closer to the wing margin. In *Ps. nigricornis* Enderlein (New Guinea) the dorsal valve of the gonapophyses is broad at the base and tapers gradually to a point whereas in *Ps. parvus* the dorsal valve is broad but narrows abruptly and distally ends in a long, finely pointed extension. *Ps. parvus* can be readily distinguished from the remaining species of the genus by differences in detail of fore wing pattern. In *Ps. malayanus* New and Lee (Peninsular Malaysia), *Ps. manus* Smithers and Thornton (Manus Island) and *Ps. nebulosus* Mockford (Philippines) there is no pale lunule near the wing margin in cell R<sub>5</sub>. In *Ps. marmoratus* Smithers and Thornton (New Guinea) there is pale lunule in cell M<sub>3</sub> near the margin but not one in that position in *Ps. parvus*. With a wing length of 4.5 mm *Ps. pulchripennis* Smithers and Thornton (New Guinea) is larger than *Ps. parvus* and the fore wing cells M<sub>1</sub>, M<sub>2</sub> and M<sub>3</sub> are centrally darker than they are adjacent to the veins. In addition to the above and other wing pattern differences, differences in detail

in the male and female genitalia, shape of the male paraprocts, differences in the shape and arrangement of setae and sclerotization of the subgenital plate and in the sclerites associated with the entrance to the spermatheca can be used to identify the species.

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## BOOK REVIEW

Butterflies of the Solomon Islands: systematics and biogeography. By John Tennent. Storm Entomological Publications, Dereham, UK; October 2002; xxiv + 413 pp; hardback. ISBN 0-9542045-0-6. Available from the author.

Until now, the butterfly fauna of the large and complex group of islands that form the Solomon Archipelago has been poorly studied and documented. This new book by John Tennent addresses that problem admirably, providing a worthy companion to recent volumes on the butterflies of Australia and Papua New Guinea by Braby and Parsons respectively.

An introductory section provides useful and often fascinating information on geological history, climate, vegetation, early visitors and collectors, mimicry, biogeography, distribution and endemism, conservation and eco-tourism. The hazards faced by early collectors are well illustrated by the account of Charles Woodford, the first Resident Commissioner of the Islands, who evidently lived in 'interesting times.'

The main body of the work is the systematic section. Detailed accounts cover the 346 species and subspecies now recorded from the Islands, placed in five family chapters (including Hesperidae). Much new information is included, particularly on habits and distribution. The Papilionidae chapter includes a detailed (and factual) account of the capture of the type and other specimens of *Ornithoptera victoriana*, a story entertaining enough without the fanciful embellishments of earlier accounts. An appendix to the systematic section provides full label data for all the specimens examined; in effect this is a useful database for Solomon Islands material and includes data from early as well as recent material. A gazetteer helps resolve the complex island nomenclature and a series of maps preceding the introduction helps locate them.

The butterflies themselves are superbly illustrated on 84 colour plates, including many taxa previously illustrated only in black and white (or not at all). All illustrations are life-size and those of *Ornithoptera victoriana* subspecies (6 plates) and *Chilasa toboroi* are particularly striking. The author has described many new taxa in recent years (including some in the *Australian Entomologist*), and it is a visual delight to see them assembled together in one place. Four additional colour plates illustrate habitats.

As the author notes, many new taxa undoubtedly await discovery, particularly in the under-explored mountainous interiors of many of the islands. By bringing together what is currently known, the present volume will undoubtedly act as a stimulus to further investigation. Identification of Solomon Islands material no longer presents almost insurmountable problems and the bibliography provides a detailed compendium of relevant literature. The book is well written and attractively presented. I have no doubt it will appeal to all those interested in butterflies (and natural history generally) in the southwestern Pacific.

David L. Hancock  
Cairns

# **LIFE HISTORY, BIOLOGY, HOST PLANTS AND NATURAL ENEMIES OF THE LILLY PILLY PSYLLID, *TRIOZA EUGENIAE* FROGGATT (HEMIPTERA: TRIOZIDAE)**

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## **Abstract**

The lilly pilly psyllid, *Trioza eugeniae* Froggatt, attacks the flush growth of the magenta lilly pilly, *Syzygium paniculatum*. The nymphs form pit galls on expanding leaves, distorting and stunting plant growth. Rearing experiments showed that the psyllid was able to complete its life history on 7 species of trees belonging to 3 allied genera in the Myrtaceae: *Acmena*, *Syzygium* and *Waterhousea*. Birds, spiders, coccinellids, ants and a tettigoniid were recorded as predators of *T. eugeniae* eggs, nymphs and adults. The most important natural enemy was the eulophid parasitoid *Tamarixia* sp.

## **Introduction**

The lilly pilly psyllid, *Trioza eugeniae* Froggatt, is native to eastern Australia and is a serious pest of young trees of magenta lilly pilly, *Syzygium paniculatum* (e.g. Morgan 1984, McMaugh 1985, Downer *et al.* 1991, Mead 1994, Dahlsten *et al.* 1995). *S. paniculatum* is native to four patches of littoral rain forest on the NSW coast (Floyd 1989) and has become a popular ornamental tree in South Australia, Victoria, New South Wales and Queensland (GRY unpublished data). It is also planted in the USA where it is used in topiary (Mead 1994, Dahlsten *et al.* 1995). The recent introduction of *T. eugeniae* to the USA has resulted in severe damage to ornamental *S. paniculatum* (Downer *et al.* 1991, Mead 1994).

Females oviposit along the margins of newly opened leaves of the flush growth. First instar nymphs hatch and crawl to the undersides of the expanding young leaves, where they settle. Subsequent instars develop in cup-shaped pit galls (Morgan 1984, Downer *et al.* 1991, Luft and Paine 1997b). At high densities nymphs also form galls on the upper sides of leaves, developing fruit, shoots and young branchlets (Downer *et al.* 1991, Dahlsten *et al.* 1995, GRY unpublished data). The gall grows with each instar and at the end of the fifth instar the adult emerges through a slit in the dorsal exoskeleton (Morgan 1984, Downer *et al.* 1991). Galling of flush results in distorted and stunted growth, both in nursery stock and recently planted young trees (GRY unpublished data). Additionally, the nymphs produce a dry, powdery honeydew which covers the leaves of the plants and, along with galling, reduces the aesthetic quality of ornamental plants (Luft and Paine 1997a).

When discussing the host range of psyllids, Hodkinson (1974) defined a host plant as a species on which a psyllid could complete its life history. Psyllid nymphs generally only feed on one or several closely related host species (Taylor and Carver 1991). Froggatt (1901) described *T. eugeniae* from



*Eugenia smithii* (Myrtaceae), now known as *Acmena smithii*. The names *E. smithii* and *Syzygium smithii* were, until recently, often used incorrectly in the Australian nursery trade for *S. paniculatum* (GRY unpublished data), so it is possible that Froggatt's record was from *S. paniculatum*. Morgan (1984), Mead (1004) and Luft and Paine (1998) all stated that *T. eugeniae* had a narrow host range and probably was confined to *S. paniculatum*. However, *Acmena*, *Syzygium* and *Waterhousea* are allied genera of trees in the family Myrtaceae found in rainforests extending from southeastern to northeastern Australia, with some species also found in the monsoon forest and savanna woodland of the Northern Territory (Hyland 1983, Floyd 1989). Many species belonging to these three genera show insect damage similar to that caused by *T. eugeniae* on *S. paniculatum* (GRY unpublished data).

Little has been published on the natural enemies of *T. eugeniae* (Dahlsten *et al.* 1995), the exception being the nymphal parasitoid *Tamarixia* sp. (Hymenoptera: Eulophidae), which was introduced from Australia into California for the biological control of the psyllid (Mead 1994, Dahlsten *et al.* 1995, Luft and Paine 1998).

This paper describes observations on the biology, life history, host range and natural enemies of *T. eugeniae*, which either differ from published data or had not been recorded previously.

### Material and methods

Adult *T. eugeniae* were collected from a single tree of *S. paniculatum* growing in a backyard at Ryde, NSW. A stock culture of *T. eugeniae* was established on cuttings raised from the same tree. The cuttings were struck in quartz gravel and transplanted into 200 mm diameter pots. Host plants were fed weekly with Aquasol® at a concentration equivalent to 100 ppm of nitrogen. Pots, each containing 2 host plants, were placed in 450 x 450 x 450 mm aluminium framed cages enclosed with 0.6 mm polyamide gauze. The cages were placed in a glasshouse where the daily temperature ranged from 18-26°C. Observations were made on the life history and behaviour of *T. eugeniae* both in the cages and in the field. Measurements of life stages were made under a stereomicroscope using an eye-piece micrometer.

To test the host range of *T. eugeniae*, cuttings were taken from 13 species of trees at the Ryde School of Agriculture, belonging to the genera *Acmena*, *Syzygium* and *Waterhousea* (Table 1). The cuttings were raised in pots as described above and each pot was placed in a cage with 2 female and 5 male *T. eugeniae*. Adults were removed from the cages 48 hours after the start of oviposition. The cages were kept under observation until either *T. eugeniae* completed two generations or all the life stages died. A generation was defined as from one egg stage to the next. Field observations were made on the same species of *Acmena*, *Syzygium* and *Waterhousea* (Table 1) at the Ryde School of Horticulture and the Royal Botanic Gardens, Sydney.

**Table 1.** Survival of *Trioza eugeniae* on different host plants in cages and in the field.

Host species	Generations completed in cages	Remarks
<i>Syzygium australe</i>	2	Adults, eggs and nymphs in the field
<i>Syzygium francisii</i>	<1	Adults fed, oviposition, infested leaves shed at instars 2 and 3. No nymphs in pit galls in the field
<i>Syzygium hodgkinsoniae</i>	0	Adults fed, no oviposition
<i>Syzygium luehmannii</i>	1	Adults fed, oviposition, most infested leaves shed at instars 2 and 3. No nymphs in pit galls in the field
<i>Syzygium moorei</i>	2	Adults, eggs and nymphs in the field
<i>Syzygium oleosum</i>	2	Adults, eggs and nymphs in the field
<i>Syzygium paniculatum</i>	2	Adults, eggs and nymphs in the field
<i>Syzygium wilsonii</i> ssp. <i>wilsonii</i>	<1	Adults fed, oviposition, infested leaves shed at instars 3 to 5. Nymphs in pit galls in the field
<i>Acmena hemilampra</i>	0	Adults fed, oviposition, nymphs did not develop beyond instar 2
<i>Acmena ingens</i>	2	Adults, eggs and nymphs in the field
<i>Acmena smithii</i> type	0	Adults fed, oviposition, nymphs did not develop beyond instar 2
<i>Acmena smithii</i> rheophytic race	0	Adults fed, no oviposition
<i>Waterhousea floribunda</i>	2	Adults, eggs and nymphs in the field

To measure the fecundity of *T. eugeniae*, 15 cages were set up, each containing a potted *Syzygium oleosum* with one newly emerged female and 3 male *T. eugeniae*. The potted host plants were removed each day and counts made of the number of eggs laid. Plants with eggs were retained to determine percentage egg hatch and replaced in the cages with fresh plants.

Observations were made on the natural enemies of *T. eugeniae* both in cages and in the field. To determine the incidence of the parasitoid *Tamarixia* sp. in different life stages of *T. eugeniae*, a total of 25 shoots were sampled each week from young *S. paniculatum* and *S. oleosum* trees. Counts were made of each nymphal stage and parasitised nymphs were cut from leaves and held in glass vials for parasite emergence. To determine the development period for the parasitoid, 4 field collected females were caged with 30 newly moulted fourth instar nymphs of *T. eugeniae*.

## Results

Body length for adult *T. eugeniae*, from the tip of the head to the tip of the abdomen, was  $1.6 \text{ mm} \pm 0.03$  (range 1.4-1.8 mm,  $n = 13$ ) for males and  $1.8 \text{ mm} \pm 0.04$  (range 1.7-1.9 mm,  $n = 12$ ) for females. Body length from the tip of the head to the tip of the folded wings was  $2.8 \text{ mm} \pm 0.04$  (range 2.5-3.0 mm,  $n = 13$ ) for males and  $3.05 \text{ mm} \pm 0.04$  (range 2.7-3.2 mm,  $n = 12$ ) for females. Both sexes had a white wax-like covering on both the first and pregenital abdominal tergites. Recently emerged adults fed around the margins of the pits from which they emerged, as well as on the reverse side of the pit, before dispersing. When feeding, adults continually moved their raised abdomens from side to side through an angle of  $20^\circ$ . In periods between oviposition on expanding leaves, females descended to flush branchlets to feed.

Eggs were yellow in colour and fusiform, more tapered at one end than the other, with the blunt end inserted into the margin of the expanding leaf. Eggs were a mean of  $0.34 \text{ mm} \pm 0.003$  (range 0.27-0.36 mm) in length and  $0.1 \text{ mm} \pm 0.007$  (range 0.09-0.13 mm) at the widest point ( $n = 34$ ). Hatching occurred between 0600 and 0800 h and the first instar nymphs remained motile for up to 7 hours before settling on the underside of the leaf. First instar nymphs were flattened dorsally and convex ventrally, a body length of  $0.36 \text{ mm} \pm 0.004$  (range 0.33-0.38 mm) in length and a width of  $0.17 \text{ mm} \pm 0.007$  (range 0.13-0.18 mm) across the mesothorax ( $n = 25$ ). The dorsal sclerites of the head, thorax and abdomen were confluent, forming a dorsal shield with the legs and antennae protruding beyond the margin of the shield. After moulting to second instar a shallow pit began to develop beneath the nymph. The dorsal shield became larger, relative to the rest of the nymph, and a narrow wax-like fringe developed around the margin of the shield. The wax-like fringe was found in succeeding instars and appeared to seal the nymph in the pit. Pits became deeper and wider with each instar. Once the leaf was fully expanded instars 2 to 4 did not undergo further moults and subsequently died. When third, fourth or fifth instars were dislodged from their pits the nymphs were motile, but unable to settle on the leaf or re-establish in empty pits. Dislodged nymphs eventually died of desiccation.

In the field, instars 1 and 2 were the most susceptible to desiccation. From 2-8 January 1994 maximum temperatures were between 33 and  $39^\circ\text{C}$ , resulting in 100% mortality of instars 1 and 2, while some later instars survived.

*Trioza eugeniae* was able to complete two generations on caged *Syzygium australe*, *S. moorei*, *S. oleosum*, *S. paniculatum*, *Acmena ingens* and *Waterhousea floribunda*. Additionally, all life stages were found on these hosts in the field. *T. eugeniae* was able to complete one generation on caged *S. luehmannii*; however most infested leaves were shed when the nymphs reached instars 2 and 3. Empty pit galls were found on *S. luehmannii* and *S. francisii* in the field. Adults fed and oviposited on caged *S. francisii* and

*S. wilsonii* ssp. *wilsonii* but infested leaves were shed before the nymphs reached instar 5. Pit galls containing nymphs were found on leaves of *S. wilsonii* ssp. *wilsonii* in the field. *T. eugeniae* fed and oviposited on caged *A. hemilampra* and *A. smithii* type but the nymphs did not develop beyond instar 2. No pit galls were found on either of these plants in the field. On caged *S. hodgkinsoniae* and *A. smithii* rheophytic race adults fed without ovipositing and no *T. eugeniae* life stages were found on these hosts in the field.

Females mated within 24 h of introduction to the cages containing potted *S. oleosum* and oviposition began up to 48 h after mating. Of the 15 females, 2 died without laying eggs. The remaining 13 females lived for a mean of 11 days (range 4-18 days) and continued to mate throughout their lives. Females laid a mean of 18 eggs per day (range 6.4-35.5). Over their entire lifetime, females laid a mean of 198 eggs (range 109-331). There was no statistical relationship between longevity and the number of eggs laid,  $r = 0.01$ , but larger females laid more eggs than smaller ones. Egg hatch per female was 89% (range 72-100%). Eggs hatched in a mean of 4 days (range 3-7 days,  $n = 2,579$ ).

Birds observed feeding on *T. eugeniae* were the noisy miner, *Manorina melanocephalus* (Latham) and the red wattle bird, *Anthochaera carunculata* (White). Invertebrate predators of *T. eugeniae* nymphs were: larvae and adults of the coccinellids *Cryptolaemus montrouzieri* Mulsant, *Halmus chalybeus* (Boisduval) and *Harmonia conformis* (Boisduval) (Coleoptera); larvae of an unidentified syrphid (Diptera); the tramp ants *Pheidole megacephala* (Fabricius) and *Technomyrmex albipes* (F. Smith), and the native ant *Iridomyrmex* sp. (Hymenoptera). Second and third instar nymphs of *Conocephalus semivittatus* (Walker) (Orthoptera: Tettigoniidae) were observed feeding on *T. eugeniae* eggs. The spiders *Oxyopes* sp. (Oxyopidae) and a species of Salticidae were observed attacking newly emerged *T. eugeniae* adults.

The nymphal parasitoid *Tamarixia* sp. (Hymenoptera: Eulophidae) was the only parasitoid found attacking *T. eugeniae*. Parasitised nymphs from instars 2-5 were recovered from the field and emergence holes were recorded from the cadavers of instars 3, 4 and 5. Percent parasitism of field populations of *T. eugeniae* ranged up to 3, 22, 62 and 47% for instars 2, 3, 4 and 5 respectively. Development time for *Tamarixia* sp. from oviposition to adult emergence was a mean of 17 days (range 16-19 days,  $n = 26$ ).

## Discussion

The wax-like covering on the dorsal abdominal sclerites combined with the side-to-side movements of adults when feeding are possibly strategies to confuse predators. Recently emerged adults fed around vacated pit galls suggesting that, for a short period, this tissue may be nutritionally superior to non-galled parts of shoots and leaves. Hodkinson (1984) maintained that gall formation produced a nutrient sink, which offered a higher quality of soluble

nutrients than the surrounding mature leaf tissue. At the time of adult emergence the leaf tissue was becoming mature with a corresponding decline in the levels of soluble nutrients available to the psyllid, so feeding around the empty pit may have given young adults a nutritional boost before dispersing to feed on flush growth.

The dorsal shield with the surrounding wax-like fringe in instars 2-5 appears to seal nymphs in the pit galls, thereby preventing desiccation. This observation agrees with Hodkinson (1974), who stated that nymphal stages of psyllids exhibited morphological and behavioural adaptations to resist desiccation.

The inability of nymphs from instars 2-5 to develop on expanded leaves indicates that *T. eugeniae* is dependent on flush growth to complete its development. Since seedlings and young trees have a higher proportion of flush growth than mature trees, these stages are more attractive to the psyllid and consequently suffer more damage.

*Trioza eugeniae* was able to survive and reproduce on six species of tree in three different genera. *Syzygium luelmannii*, *S. francisii* and *A. wilsonii* ssp. *wilsonii* appeared able to support populations of *T. eugeniae*, although nymphal mortality was high. There are 7, 52 and 4 species of *Acmena*, *Syzygium* and *Waterhousea* respectively recorded from Australia (Hyland 1983). Since *T. eugeniae* has been recorded from Adelaide in South Australia to Atherton in northern Queensland, the host range of the psyllid is probably more extensive than the current study indicates (Morgan 1874, Dahlsten *et al.* 1995, GRY unpublished data). The wide host range of *T. eugeniae* is unusual as most species of psyllids are specific to one or two closely related species of host plant (Hodkinson 1984, Taylor and Carver 1991). For example, a closely related *Trioza* sp. from the Northern Territory has only been recorded from *Syzygium suborbiculare* (GRY unpublished data, G. Taylor pers. comm.).

The mean fecundity of 198 eggs per female was higher than the 152 eggs recorded by Downer *et al.* (1991). The difference probably can be explained by the high concentration of nitrogen fed to the host plants and the regular provision of fresh hosts. Downer *et al.* (1991) noted that the number of eggs laid was dependent on the availability of oviposition sites. Luft and Paine (1997b) and Luft *et al.* 2001a, 2001b) found that *T. eugeniae* females preferred to oviposit on the margins of unexpanded leaves and, if females encounter a fully occupied margin, they will oviposit on another suitable leaf if available.

*Trioza eugeniae* has a wide variety of vertebrate and invertebrate predators but their effect on the psyllid populations is unknown. The tettigoniid *Conocephalus semivittatus* is a commonly recorded predator of hemipteran eggs (Rentz 1996, GRY unpublished data).

The only parasitoid recovered was *Tamarixia* sp. Fourth and fifth instar *T. eugeniae* nymphs were the preferred hosts with parasitism of 62 and 47% respectively. This indicates that *Tamarixia* sp. probably controls *T. eugeniae* populations. The results differ slightly from those of Dahlsten *et al.* (1995), who found that third and fourth instar nymphs were the preferred hosts, while the development time for *Tamarixia* sp. was 14 days compared with the 17 days of the current study.

### Acknowledgements

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# THE IDENTITY OF SIR JOSEPH BANKS' "WRATHFULL MILITIA": THE LARVAE OF *DORATIFERA STENORA* TURNER (LEPIDOPTERA: LIMACODIDAE)

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## Abstract

A description of an encounter with stinging caterpillars on 23 May 1770 at Bustard Bay, Queensland in Joseph Banks' Endeavour journal refers to larvae of *Doratifera stenora* Turner and is the first record of Limacodidae from Australia. Mature larvae of *D. stenora* matching Banks' description were collected in April 1999 at Ningi, southeastern Queensland, feeding on leaves of Spotted mangrove, *Rhizophora stylosa* Griffith (Rhizophoraceae). Notes on the life history, larval morphology and distribution of *D. stenora* are provided. Larvae of *D. stenora* differ markedly from those of other species of *Doratifera* Duncan [& Westwood]. It is the only known species with gregarious mature larvae and the only species known to feed on Rhizophoraceae. Mature larvae have a full complement of 10 pairs of lateral and 10 pairs of subdorsal scoli, all apparently armed with stinging setae. They lack the pairs of subdorsal protuberances armed with eversible rosettes of stinging setae that are characteristic of other known *Doratifera* larvae.

## Introduction

The first species of cupmoth (Limacodidae) to be described from Australia was *Comana coronae* (Fabricius), an adult of which was collected on Cook's first voyage in 1770 at the present site of Cooktown (Edwards 1996). Slightly earlier in the voyage Sir Joseph Banks made reference in his journal to caterpillars that have been thought to belong to a species of limacodid by virtue of their stinging ability (Musgrave 1954, Waterhouse 1971).

On 23 May 1770, the Endeavour was anchored in Bustard Bay near the site of the present day town of Seventeen Seventy, Queensland. Banks' journal entry for that date included the passage below that follows another describing an encounter with Green tree ants, *Oecophylla smaragdina* (Fabricius) (Musgrave 1954).

'The Mangroves had also another trap which most of us fell into, a small kind of Caterpiler, green and beset with many hairs: these sat upon the leaves many together rangd by the side of each other like soldiers drawn up, 20 or 30 perhaps upon one leaf; if these wrathfull militia were touchd but ever so gently they did not fail to make the person offending them sensible of their anger, every hair in them stinging much as nettles do but with a more acute tho less lasting smart.' (Banks 1962: 66).

Beaglehole, the editor of the 1962 edition of Banks' journal, noted that the caterpillars were almost certainly those of a limacodid belonging to the genus *Doratifera* Duncan [& Westwood]. Burwell (2000) reported the discovery of the same larvae feeding on Spotted mangrove, *Rhizophora stylosa* Griffith (Rhizophoraceae), near Bribie Island in southeastern Queensland. Adults

were reared from these larvae and provisionally identified as a species of *Doratifera* (Burwell 2000). Subsequently they were identified as *Doratifera stenora* Turner by EDE. Notes on the distribution and life history of the species are provided below.

### Observations

Mature larvae of *D. stenora* were collected by Peter Davie and Bronwyn Searle on 12 April 1999 at Ningi (27°02'S 153°06'E), just north of Brisbane, in mangroves lining Pumistone Passage opposite the southern end of Bribie Island. The larvae closely matched Banks' description and were clustered together, side-by-side, in groups of between 9 and 21, on the undersides of leaves of Spotted mangrove, *R. stylosa* (Fig. 1). All larvae of each row had their heads directed towards the leaf margins. They were tightly packed with much of the lateral edges of adjacent larvae in close contact (Fig. 2). The larvae were reared in captivity on *R. stylosa* foliage and pupated within stiff, brown, rounded cocoons, approximately 9 mm long and 6 mm wide, that were spun between leaves. Adult specimens have been deposited in the Queensland Museum, Brisbane (QM) and the Australian National Insect Collection, Canberra (ANIC).

### Larval morphology

Unfortunately, the significance of the larvae was not realised at the time and notes on their morphology were not made, nor were larvae preserved. Consequently, the following larval description is based primarily on Figs 1 and 2.

*Mature larva.* Length, including scoli, approximately 18 mm. Mottled green dorsally with thin, darker green central line along most of length; pair of broader dark green stripes either side of central line but mesad of bases of subdorsal scoli, each stripe enclosing a series of pale spots, one per segment; thoracic tergum 1 mostly white, with central plate bearing two black, comma-shaped markings; posterior end of larva with pair of black spots. Paired, relatively short, conical, lateral scoli present on thoracic segments 2 and 3 and abdominal segments 2-9; lateral scoli of similar length except those on abdominal segment 9 conspicuously longer; paired subdorsal scoli present on thoracic segments 2 and 3 and abdominal segments 1-8; subdorsal scoli mostly directed dorsally, relative lengths unable to be determined from Figs 1 and 2; subdorsal scoli on thoracic segment 2 projecting anteriorly to some extent, conspicuously longer than lateral scoli of same segment; all scoli appear armed with strong setae, more densely on subdorsal scoli.

### Distribution and host plant

*Doratifera stenora* occurs in the southern half of Queensland and far northern New South Wales, east of the Great Dividing Range. In addition to Bustard Bay and Ningi, specimens of *D. stenora* in the QM and ANIC have been collected from Shute Harbour, Yeppoon, Rockhampton (syntype male and

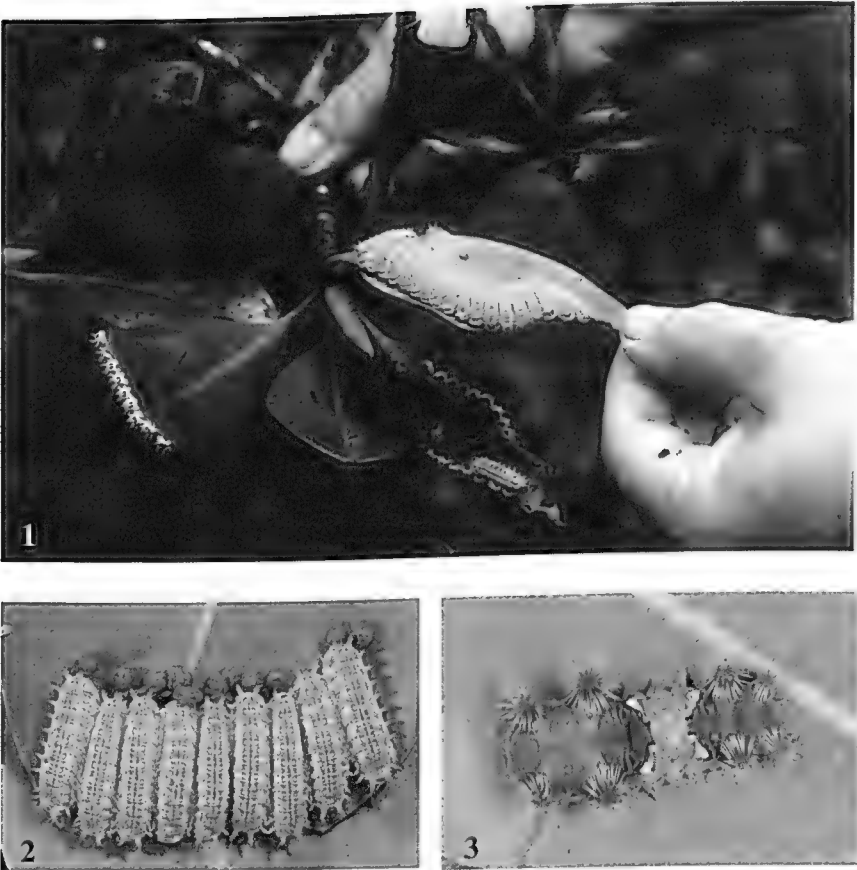
female), Curtis Island, Gladstone, Cooroy, Borumba Dam, Bunya Mountains and Mount Tamborine in Queensland and Sheepstation Creek, Border Ranges National Park in northern New South Wales. Adults from Gladstone were reared from cocoons on *Rhizophora stylosa* by N. Duke while those from Curtis Island were reared from larvae also on *R. stylosa* by W. Houston. Hockey and DeBaar (1991) recorded adults of *Doratifera unicolor* Swinhoe reared from cocoons collected on the stem of *R. stylosa* at Mary River Heads near Maryborough, Queensland. This record almost certainly refers to *D. stenora* which was incorrectly synonymised with *D. unicolor* by Turner (1926).

Interestingly, adults of *D. stenora* have been collected at several localities that are considerable distances from the coast and the nearest *Rhizophora* plants. In particular, specimens have been taken in montane rainforest at Mount Tamborine and the Border Ranges around 25 km from the coast, while those from the Bunya Mountains were collected in the order of 150 km from the coast. Presumably the larvae develop on an alternative host plant in these localities. It is also possible that specimens from these non-coastal, rainforest localities may represent a different species although their genitalia are identical to those of coastal specimens associated with mangroves. However, adults of *Doratifera quadriguttata* (Walker) and *D. casta* (Scott) have very similar adults and genitalia, yet have dramatically different larvae. Consequently the status of the non-coastal populations of *D. stenora* can not be resolved until their foodplants and larvae are discovered.

## Discussion

The genus *Doratifera* has a wide distribution in mainland Australia and Tasmania (Common 1990) and includes 8 described species (Edwards 1996). The life history and larvae of *D. stenora* differ significantly from those of other species, of which the life history is known, in the genus.

Firstly, *D. stenora* is the only species utilising a foodplant within the Rhizophoraceae. Other known *Doratifera* larvae feed mostly on plants within the Myrtaceae, particularly species of *Eucalyptus* but also species of *Lophostemon*, *Angophora*, *Melaleuca* and Guava, *Psidium guajava* (Common 1990). *Doratifera vulnerans* (Lewin) has also been recorded feeding on Apricot, *Prunus armeniaca* (Rosaceae) (Common 1990). Secondly, the gregarious habit of the mature larvae of *D. stenora* is unusual for the genus. Mature larvae of other species of *Doratifera* are generally 'solitary' feeders although the early instars of some, for example *D. casta*, may feed gregariously (CJB pers. obs.). However, Turner (1902) noted that the larvae of *Lamprolepida chrysochroa* (R. Felder) fed gregariously on *Planchonia careya* (Barringtoniaceae) at Townsville, Queensland. *Doratifera* and *Lamprolepida* Turner may be closely related genera as both have veins Sc+R<sub>1</sub> and R<sub>s</sub> fused for at least half the length of the discal cell in the hindwing (Turner 1926).



**Figs 1-3.** Mature larvae of *Doratifera* spp. (1) *D. stenora* in situ on the undersides of leaves of Spotted Mangrove, *Rhizophora stylosa*. (2) Dorsal view of *D. stenora*. Note the full complement of 10 pairs of lateral scoli. All but the most anterior pairs of subdorsal scoli (top) are obscured against the greenish coloration of the larvae. (3) Dorsal view of *D. vulnerans*. Note the 2 pairs of anterior (left) and 2 pairs of posterior subdorsal protuberances bearing eversible rosettes of stinging hairs.

Most significantly, the larval morphology of *D. stenora* differs markedly from that of other species of *Doratifera*. Mature *D. stenora* larvae have a full complement of 10 pairs of lateral and 10 pairs of subdorsal scoli that are well-developed and all of which bear strong, presumably stinging setae. In contrast, other known *Doratifera* larvae have at least some of the subdorsal scoli on the abdominal segments conspicuously reduced in size or absent.

In addition, they have stinging setae confined to two pairs of anterior and sometimes two additional pairs of posterior subdorsal protuberances (Fig. 3). These protuberances appear to be modified scoli that bear expandable rosettes of stinging setae (Fig. 3). All the subdorsal scoli of *D. stenora* larvae are unmodified.

Given that *D. stenora* larvae are vastly different from those of other members of the genus, including the type species *D. vulnerans*, the taxonomic position of *D. stenora* may warrant examination in any future detailed work on *Doratifera*.

### Acknowledgements

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